



POLITECNICO DI MILANO

Piazza Leonardo da Vinci, 32 - 20133 Milano
Tel. +39.02.2399.1 - <http://www.polimi.it>



Advanced course on

**HIGH RESOLUTION ELECTRONIC MEASUREMENTS
IN NANO-BIO SCIENCE**

WELCOME & INTRODUCTION

Marco Sampietro, Giorgio Ferrari

12 Departments



Design, Architecture and Urban Studies (3000 st.) Engineering (30.000 st.)



Chemistry, Energy, Physics, Civil, Ambient, Mechanics, Aerospace, Material science, Mathematics, Business

Elettronics, Information technology and Bioengineering

Automation & system control, Bioengineering, Computer Science, Electrical Engineering
Electronics, Telecommunication

1963 Chemistry Nobel Laureate : Prof. **Giulio Natta**
for his discoveries in polymer science



The ORGANIZERS



Marco Sampietro



Giorgio Ferrari

- Design of Electronic circuits to access the electronic properties of nano-bio devices
- On-chip multichannel instrumentation
- Special purpose Integrated Circuits (Photonics, Raman, Quantum, Bio, Space,..)



POLITECNICO
MILANO 1863



**innovative
integrated
instrumentation for
nanoscience**



Staff

Marco Sampietro
Giorgio Ferrari
Francesco Zanetto
Dario Natali
Enrico Prati (Milano Un.)

Postdocs and PhDs

Michele Castriotta
Alessandro Perino
Giuseppe Barbalace
Alessandro Di Tria
Emanuele Sacchi
Giulio Gubello
Arianna Maurina
Caina de Oliveira Figares

Collaborations:

Photonic Devices Group

A. Melloni, F. Morichetti

Nanomagnetism group

R. Bertacco, D. Petti



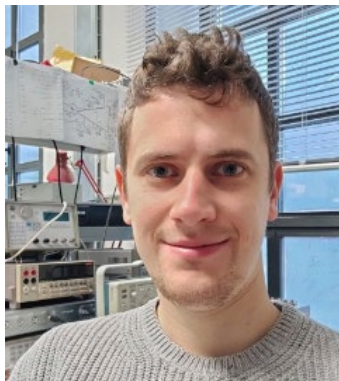
polifab
POLITECNICO DI MILANO

Supported by :





Our SPEAKERS



*Francesco
Zanetto*

Electronics
for Integrated
Photonic
systems



*Marco
Carminati*

Sensors &
systems for High
Energy Physics,
X-rays & Biology



*Laura
Fumagalli*

AFM &
nanophysics
specialist
(Manchester, UK)



*Enrico
Prati*

Quantum
physics and
devices for
computing

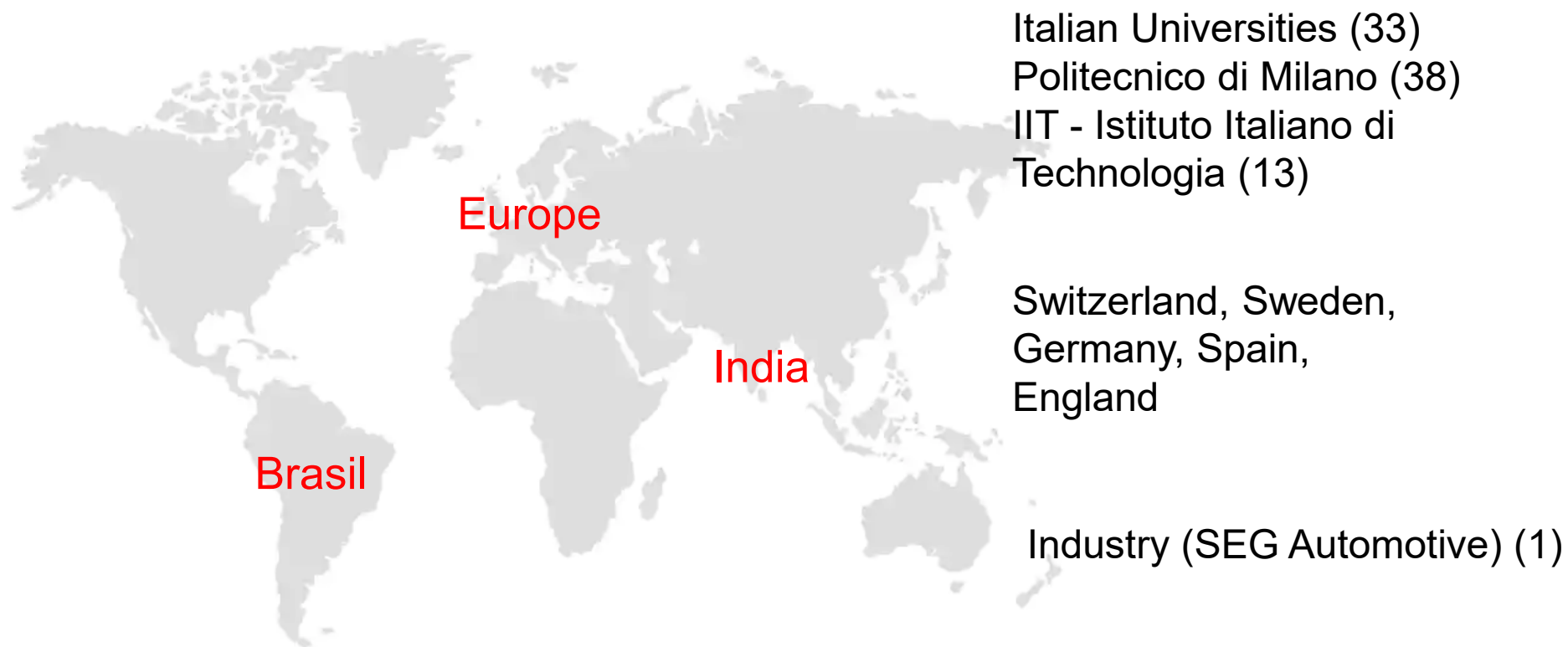


*Andrea
Melloni*

Photonic
Integrated
systems



99 PARTICIPANTS





The COURSE : 8° edition

	Monday 5	Tuesday 6	Wednesday 7	Thursday 8	Friday 9
9.15 45m + 15m		Measuring at a given frequency <i>The LOCK-IN concept</i> Marco Sampietro	Electrical measurements in liquids <i>Basic considerations</i> Giorgio Ferrari	Differential measurements <i>When, why and how</i> Giorgio Ferrari	Instrumentation for noise measurements <i>Noise as signal</i> Marco Sampietro
10.15 45m + 15m		Impedance measurement <i>Architectures and performance</i> Marco Sampietro	The interface between solid & liquid <i>How to transfer charge through the electrodes</i> Giorgio Ferrari	Instrument-on-chip <i>How to design it</i> Giorgio Ferrari	Probing at the nanoscale <i>Principles of AFM</i> Laura Fumagalli Manchester Un. (UK)
15m		Tea break	Tea break	Tea break	Tea break
11.45 45m + 15m		High resolution measurements in nanoscience <i>Sub-ppm measurements using lock-in amplifiers</i> Giorgio Ferrari	Charge transport in liquids <i>A closer approach</i> Giorgio Ferrari	Analog vs Digital processing <i>FPGA, Microprocessors & others</i> Francesco Zanetto	Electrical measurements with AFM Laura Fumagalli Manchester Un., UK
		Lunch break	Lunch break	Lunch break	
13.45	Introduction to the course Marco Sampietro				Conclusive remarks M.Carminati, G. Ferrari and M. Sampietro
14.15 45m + 15m	It is all about noise! <i>A practical review of noise properties</i> Marco Sampietro	Integrated Photonics <i>The need to peep light</i> Andrea Melloni	Electrochemical instrumentation <i>Probing the interface</i> Marco Carminati	Quantum computer hardware <i>An introduction</i> Enrico Prati Università degli Studi, Milano	
15.15 45m + 15m	Measuring small currents <i>The Transimpedance Amplifier - TIA</i> Marco Sampietro	Transparent detection of light <i>Devices & control electronics</i> Francesco Zanetto	Current measurements in bioscience <i>Examples of applications</i> Marco Carminati	Spin Qbit <i>Basic description</i> Enrico Prati Università degli Studi, Milano	
15m	Tea break	Tea break	Tea break	Tea break	
16.30 45m + 15m	Advanced TIAs <i>Architectures & Instrumentation</i> Marco Sampietro	Lock-in extension to multiple signals <i>Modulation & dithering</i> Francesco Zanetto	Nanoscale Electrochemistry Giorgio Ferrari	Cryogenic electronics for quantum devices <i>Measuring below 4K</i> Giorgio Ferrari	

<https://sampietro.faculty.polimi.it/Nano/programma.html>



GOAL of the COURSE

In the past, you basically needed to buy the right instrument and use it properly, to perform a perfect experiment.

Nowaday, things are changing dramatically because devices and set-ups very often are at a micrometric scale.



Measuring circuits embedded into the experiment

Sensors reading circuits integrated into the same IC

- Drive this change
- Have solid grounds and know the advantages in perfectly coupling the reading electronics into your system
- Interact with electronic specialists toward the best design for you



PRACTICALITIES (1)

An **ATTENDANCE CERTIFICATE** will be given at the end of the Course (if required by your institution)

An **EXAM** will be organized for those who require it :

Performed on a WEB application

About 20 questions with multiple answers

You connect from your site

A certificate will be provided upon completion of the exam

We have to decide together when :

?



PRACTICALITIES (2)

Today at 17.30, at the end of the lessons, a little “**Aperitivo insieme**” in this classroom, to relax together.

Tomorrow, Tuesday, some of you are organizing a dinner in a pizza restaurant. Those of you interested may answer to the Doodle for reserving the tables.



Let us start ...